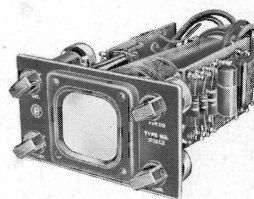


MODEL 90901
MODULE OSCILLOSCOPE

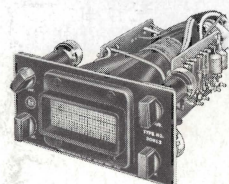
JAMES MILLEN

MANUFACTURING COMPANY, INC.

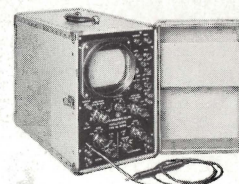
OSCILLOSCOPES AND ACCESSORIES



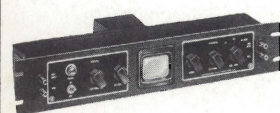
MODEL 90912
MODULE OSCILLOSCOPE



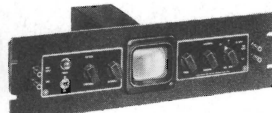
MODEL 90913
MODULE OSCILLOSCOPE



MODEL 90915
INDUSTRIAL OSCILLOSCOPE



MODEL 90902
BASIC OSCILLOSCOPE



MODEL 90903
BASIC OSCILLOSCOPE



MODEL 90905-B
BASIC OSCILLOSCOPE



MODEL 90923 RACK
MOUNTED OSCILLOSCOPE

"Designed for Performance"®

MILLEN MODULE OSCILLOSCOPES

JAMES MILLEN NUMBERS: 90901, 90911, 90912, 90912-R, and 90913

TYPICAL APPLICATIONS

Lissajous frequency comparator
Null indicator
Klystron mode indicator
Pulse jitter indicator
Neutralization indicator
Tuning indicator
Voltage output indicator
Power output indicator
Per cent modulation indicator
Phase shift indicator
Frequency drift indicator
Television camera monitor
Modulation monitor
Linearity monitor

SPECIFICATIONS

Sensitivity (Using Millen No. 90202 Power Supply)

Vertical 2.4 to 3.0 volts r.m.s. per millimeter deflection
6.9 to 8.5 volts peak to peak per millimeter deflection
62 to 76 volts r.m.s. per inch deflection
176 to 216 volts peak to peak per inch deflection

Horizontal 2.7 to 4.4 volts r.m.s. per millimeter deflection
7.6 to 12.1 volts peak to peak per millimeter deflection
68 to 112 volts r.m.s. per inch deflection
192 to 308 volts peak to peak per inch deflection

Sensitivity (Using 500 volts accelerating potential)

Vertical 1.5 to 2.2 volts r.m.s. per millimeter deflection
4.2 to 6.1 volts peak to peak per millimeter deflection
37 to 55 volts r.m.s. per inch deflection
105 to 155 volts peak to peak per inch deflection

Horizontal 1.7 to 2.4 volts r.m.s. per millimeter deflection
4.7 to 6.9 volts peak to peak per millimeter deflection
42 to 62 volts r.m.s. per inch deflection
120 to 175 volts peak to peak per inch deflection

Sensitivity (Using 1000 volts accelerating potential)

Vertical 2.9 to 4.3 volts r.m.s. per millimeter deflection
8.3 to 12.2 volts peak to peak per millimeter deflection
74 to 110 volts r.m.s. per inch deflection
210 to 310 volts peak to peak per inch deflection

Horizontal 3.3 to 4.9 volts r.m.s. per millimeter deflection
9.5 to 13.8 volts peak to peak per millimeter deflection
85 to 124 volts r.m.s. per inch deflection
240 to 350 volts peak to peak per inch deflection

Blanking Sensitivity (Using 500 volts accelerating potential)

—7 to —21 volts d.c. or peak

Blanking Sensitivity (Using 1000 volts accelerating potential)

—14 to —42 volts d.c. or peak.

Power Supply Requirement

400 to 1600 volts d.c. at 0.9 milliamperes
6.3 volts a.c. at 0.6 ampere
90202 Module Plug-in High Voltage Power Supply available

Tube Complement: 1 — RCA 1EP1, 1EP2, or 1EP11

Panel Controls: Intensity, Focus, Vertical Centering, Horizontal Centering

Physical Data Height — 2 $\frac{3}{8}$ inches overall Width — 2 $\frac{7}{8}$ inches overall
Depth — 3 $\frac{7}{8}$ inches behind panel Weight — 12 ounces

Magnetic Shield: Carefully annealed mu-metal

MILLEN MODULE OSCILLOSCOPES are miniature panel mounting basic instrumentation cathode ray oscilloscopes complete with bezel and panel control of intensity and centering. They are designed as a module to be incorporated in complete equipment. The panel space required is a minimum.

The module oscilloscopes are basic oscilloscopes with intensity and centering controls but with no amplifiers, sweep, or power supply. Both horizontal and vertical deflection sources, as well as heater and acceleration voltages, are to be taken from the equipment on which the oscilloscope is mounted. Since no amplifiers are normally supplied with the oscilloscope, the frequency response is good through the VHF band.

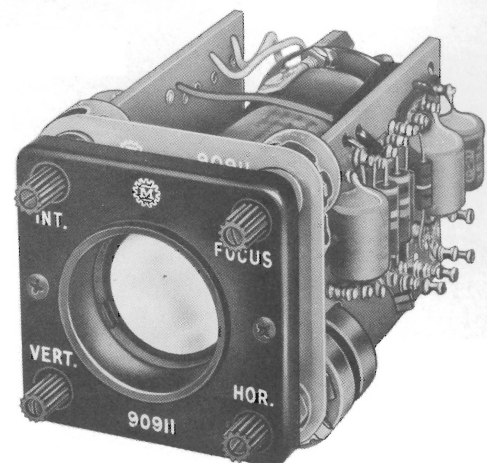
The **MILLEN No. 90202 plug-in module high voltage power supply** is available for use with any of the module oscilloscopes in applications where heater and accelerating voltages are not readily available.

The module oscilloscopes are intended for a wide variety of monitoring applications. Since an oscilloscope shows wave shape as well as magnitude, it may be used in many applications where voltmeters and milliammeters have had to suffice in the past due to the size and cost limitations of previous oscilloscopes. An oscilloscope beam has no mass and therefore no inertia. As a result, an oscilloscope responds immediately and accurately to transients which cannot be indicated by a moving coil meter.

MILLEN NO. 90911 MODULE OSCILLOSCOPE

1 $\frac{1}{4}$ INCH ROUND TUBE

flat face



FEATURES

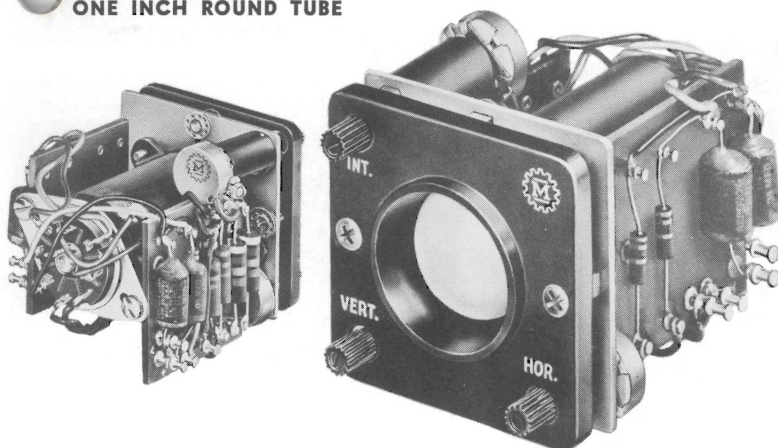
American-made Tube
P1, P2, or P11 Phosphor
Balanced Deflection
Focus Control

Low Accelerating Potential
Provisions for Blanking
1 $\frac{1}{4}$ Diameter Display
Module Construction
Miniature

The **No. 90911** is a small module oscilloscope using the American-made type 1EP1 — 1 $\frac{1}{4}$ inch diameter cathode ray tube. The No. 90911 has balanced deflection, focus control, and provisions for blanking or intensity modulation.

MILLEN NO. 90901 MODULE OSCILLOSCOPE

ONE INCH ROUND TUBE



FEATURES

Miniature
Fixed Focus
Panel Mounting
Low Accelerating
Potential

Minimum Control Interaction
Unusually Sharp Trace
Panel Matches 2" Square Meters
Weights Only 10 Ounces
Lock-in Tube Base

The No. 90901 is the smallest and most economical of the module oscilloscopes. It uses a type 1CP1 one inch diameter cathode ray tube with fixed focus.

SPECIFICATIONS

Sensitivity (Using MilLEN No. 90202 Power Supply)

Vertical 1.7 volts r.m.s. per millimeter deflection
4.7 volts peak to peak per millimeter deflection
Horizontal 2.5 volts r.m.s. per millimeter deflection
6.9 volts peak to peak per millimeter deflection

Deflection Type

Single-ended

Power Supply Requirement

600 to 950 volts d.c. at 3.2 milliamperes
6.3 volts a.c. at 0.6 ampere
MilLEN No. 90202 Module Plug-in High Voltage
Power Supply is available for this application.

Tube Complement

1 — Cossor 1CP1 Fixed focus cathode ray tube

Panel Controls

Intensity, Vertical Centering, Horizontal Centering

Physical Data

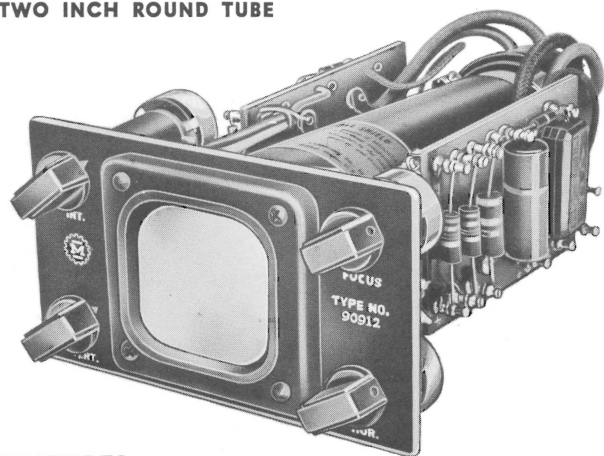
Height—2 3/4 inches overall Depth—3 7/8 behind panel
Width—2 7/8 inches overall Weight—10 ounces

Magnetic Shield

Carefully annealed mu-metal

MILLEN NO. 90912 MODULE OSCILLOSCOPE

TWO INCH ROUND TUBE



FEATURES

Large Display
P1 or P11 Phosphor
Module Construction
Miniature

Sharp Focus
Good Sensitivity
Panel Mounting
Moderate Accelerating Voltage

The No. 90912 is a small panel mounting module oscilloscope intended for instrumentation. It is complete with bezel and panel control of intensity, focus, vertical centering, and horizontal centering. It requires only 3 x 5 inches of panel space, but provides a full 2 inch diameter display.

SPECIFICATIONS

Sensitivity (Using MilLEN No. 90202 Power Supply)

Vertical 7.9 to 8.3 volts r.m.s. per centimeter deflection
22 to 23 volts peak to peak per centimeter deflection
20 to 21 volts r.m.s. per inch deflection
56 to 59 volts peak to peak per inch deflection
Horizontal 11.8 to 12.6 volts r.m.s. per centimeter deflection
33 to 35 volts peak to peak per centimeter deflection
30 to 32 volts r.m.s. per inch deflection
84 to 90 volts peak to peak per inch deflection

Sensitivity (Using 500 volts accelerating voltage)

Vertical 5.1 to 7.0 volts r.m.s. per centimeter deflection
15 to 20 volts peak to peak per centimeter deflection
13 to 18 volts r.m.s. per inch deflection
37 to 50 volts peak to peak per inch deflection
Horizontal 8.0 to 10.8 volts r.m.s. per centimeter deflection
23 to 31 volts peak to peak per centimeter deflection
20 to 27 volts r.m.s. per inch deflection
58 to 78 volts peak to peak per inch deflection

Sensitivity (Using 875 volts accelerating voltage)

Vertical 8.9 to 12.3 volts r.m.s. per centimeter deflection
26 to 35 volts peak to peak per centimeter deflection
23 to 32 volts r.m.s. per inch deflection
65 to 87 volts peak to peak per inch deflection
Horizontal 14 to 19 volts r.m.s. per centimeter deflection
40 to 54 volts peak to peak per centimeter deflection
35 to 47 volts r.m.s. per inch deflection
102 to 136 volts peak to peak per inch deflection

Power Supply Requirement

500 to 875 volts d.c. at 3.2 milliamperes
6.3 volts a.c. at 0.6 ampere
90202 Module Plug-in High Voltage Power Supply available

Tube Complement: 1 — RCA or G.E. 2 BP1 or 2BP11

Panel Controls: Intensity, Focus, Vertical Centering, Horizontal Centering

Physical Data: Height — 3 inches Width — 5 inches
Depth — 7 1/4 inches behind panel Weight — 1 3/4 pounds
Magnetic Shield: Carefully annealed mu-metal

MILLEN MODULE OSCILLOSCOPES

JAMES MILLEN NUMBERS: 90901, 90911, 90912, 90912-R, and 90913

TYPICAL APPLICATIONS

Lissajous frequency comparator
Null indicator
Klystron mode indicator
Pulse jitter indicator
Neutralization indicator
Tuning indicator
Voltage output indicator
Power output indicator
Per cent modulation indicator
Phase shift indicator
Frequency drift indicator
Television camera monitor
Modulation monitor
Linearity monitor

SPECIFICATIONS

Sensitivity (Using Millen No. 90202 Power Supply)

Vertical 17 to 18 volts r.m.s. per centimeter deflection
48 to 51 volts peak to peak per centimeter deflection
44 to 45 volts r.m.s. per inch deflection
125 to 127 volts peak to peak per inch deflection
Horizontal 14 to 15 volts r.m.s. per centimeter deflection
40 to 41 volts peak to peak per centimeter deflection
36 to 37 volts r.m.s. per inch deflection
102 to 105 volts peak to peak per inch deflection

Sensitivity (Using 750 volts accelerating voltage)

Vertical 13 to 16 volts r.m.s. per centimeter deflection
35 to 46 volts peak to peak per centimeter deflection
32 to 41 volts r.m.s. per inch deflection
90 to 116 volts peak to peak per inch deflection
Horizontal 12 to 15 volts r.m.s. per centimeter deflection
34 to 44 volts peak to peak per centimeter deflection
31 to 39 volts r.m.s. per inch deflection
87 to 111 volts peak to peak per inch deflection

Sensitivity (Using 2500 volts accelerating voltage)

Vertical 42 to 54 volts r.m.s. per centimeter deflection
118 to 153 volts peak to peak per centimeter deflection
106 to 137 volts r.m.s. per inch deflection
300 to 388 volts peak to peak per inch deflection
Horizontal 40 to 51 volts r.m.s. per centimeter deflection
114 to 146 volts peak to peak per centimeter deflection
106 to 131 volts r.m.s. per inch deflection
290 to 370 volts peak to peak per inch deflection

Blanking Sensitivity (Using 90202 Power Supply for Acceleration Voltage)

— 13 volts peak

Power Supply Requirement

750 to 2500 volts d.c. at 2.2 milliamperes
6.3 volts a.c. at 0.6 ampere
90202 Module Plug-in High Voltage Power Supply available

Tube Complement: 1 — Raytheon 3UP1 or 3UP7

Panel Controls: Intensity, Focus, Vertical Centering, Horizontal Centering

Physical Data: Height — 3 inches Width — 5 inches
Depth — 7 $\frac{3}{8}$ inches behind panel Weight — 22 ounces

Magnetic Shield: Carefully annealed mu-metal

MILLEN MODULE OSCILLOSCOPES are miniature panel mounting basic instrumentation cathode ray oscilloscopes complete with bezel and panel control of intensity and centering. They are designed as a module to be incorporated in complete equipment. The panel space required is a minimum.

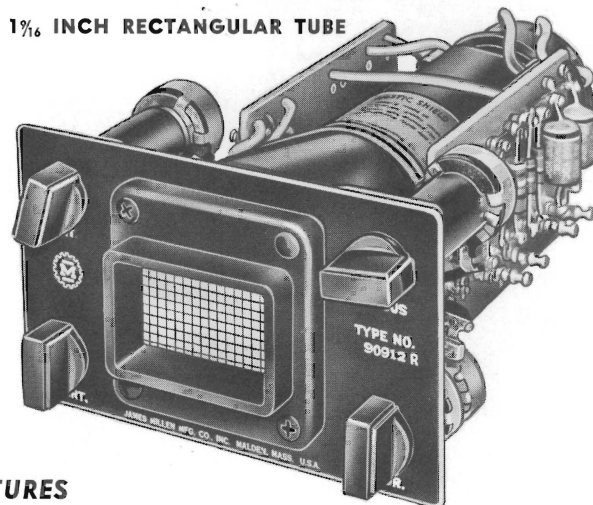
The module oscilloscopes are basic oscilloscopes with intensity and centering controls but with no amplifiers, sweep, or power supply. Both horizontal and vertical deflection sources, as well as heater and acceleration voltages, are to be taken from the equipment on which the oscilloscope is mounted. Since no amplifiers are normally supplied with the oscilloscope, the frequency response is good through the VHF band.

The **MILLEN No. 90202 plug-in module high voltage power supply** is available for use with any of the module oscilloscopes in applications where heater and accelerating voltages are not readily available.

The module oscilloscopes are intended for a wide variety of monitoring applications. Since an oscilloscope shows wave shape as well as magnitude, it may be used in many applications where voltmeters and milliammeters have had to suffice in the past due to the size and cost limitations of previous oscilloscopes. An oscilloscope beam has no mass and therefore no inertia. As a result, an oscilloscope responds immediately and accurately to transients which cannot be indicated by a moving coil meter.

MILLEN NO. 90912-R MODULE OSCILLOSCOPE

2 $\frac{1}{8}$ x 1 $\frac{1}{16}$ INCH RECTANGULAR TUBE



FEATURES

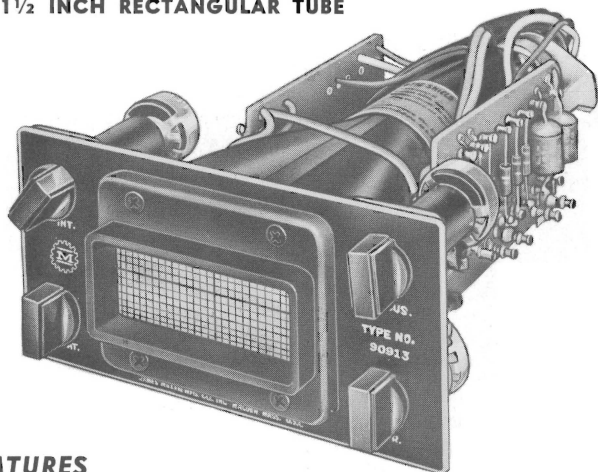
Rectangular Display
Small Panel Area
P1 or P7 Phosphor
Balanced Deflection
Provisions for Blanking

Module Construction
Accelerating Voltage — 750
to 2500v.
Display Equivalent to 2 $\frac{1}{8}$ " D.
Tube.

The **No. 90912-R** is a small panel mounting module oscilloscope using a 2 $\frac{1}{8}$ x 1 $\frac{1}{16}$ inch rectangular tube. The panel space required is only 3 x 5 inches, but the larger rectangular raster display is equivalent to a round tube with a diameter of 2 $\frac{1}{8}$ inches.

MILLEN NO. 90913 MODULE OSCILLOSCOPE

3 x 1½ INCH RECTANGULAR TUBE



FEATURES

Large Rectangular Display
P1, P2, P7, or P11 Phosphor
Balanced Deflection
Good Sensitivity

Bright Trace
Small Size
Provisions for Blanking
Module Construction

The No. 90913 is a small module oscilloscope providing the large rectangular display of a three inch tube, but requiring only the panel space used by a two inch tube. The 90913 has balanced deflection, and has provisions for intensity modulation or blanking.

SPECIFICATIONS

Sensitivity (Using Milten No. 90202 Power Supply)

Vertical 1.7 to 2.3 volts r.m.s. per centimeter deflection
4.9 to 6.6 volts peak to peak per centimeter deflection
4.4 to 5.9 volts r.m.s. per inch deflection
12 to 17 volts peak to peak per inch deflection

Horizontal 4.2 to 5.6 volts r.m.s. per centimeter deflection
12 to 16 volts peak to peak per centimeter deflection
11 to 14 volts r.m.s. per inch deflection
30 to 40 volts peak to peak per inch deflection

Sensitivity (Using 750 volts accelerating potential)

Vertical 1.5 to 2.0 volts r.m.s. per centimeter deflection
4.3 to 5.5 volts peak to peak per centimeter deflection
3.9 to 5.0 volts r.m.s. per inch deflection
11 to 14 volts peak to peak per inch deflection

Horizontal 3.5 to 4.7 volts r.m.s. per centimeter deflection
10 to 14 volts peak to peak per centimeter deflection
9.0 to 12 volts r.m.s. per inch deflection
26 to 35 volts peak to peak per inch deflection

Sensitivity (Using 2750 volts accelerating potential)

Vertical 5.5 to 7.4 volts r.m.s. per centimeter deflection
15 to 21 volts peak to peak per centimeter deflection
14 to 18 volts r.m.s. per inch deflection
39 to 52 volts peak to peak per inch deflection

Horizontal 13 to 17 volts r.m.s. per centimeter deflection
37 to 50 volts peak to peak per centimeter deflection
33 to 44 volts r.m.s. per inch deflection
94 to 126 volts peak to peak per inch deflection

Power Supply Requirement

750 to 2750 volts d.c. at 2.4 milliamperes

6.3 volts a.c. at 0.6 ampere

90202 Module Plug-in High Voltage Power Supply available

Tube Complement: 1—Waterman or DuMont 3XP1, 3XP2, 3XP7, or 3XP11

Panel Controls: Intensity, Focus, Vertical Centering, Horizontal Centering

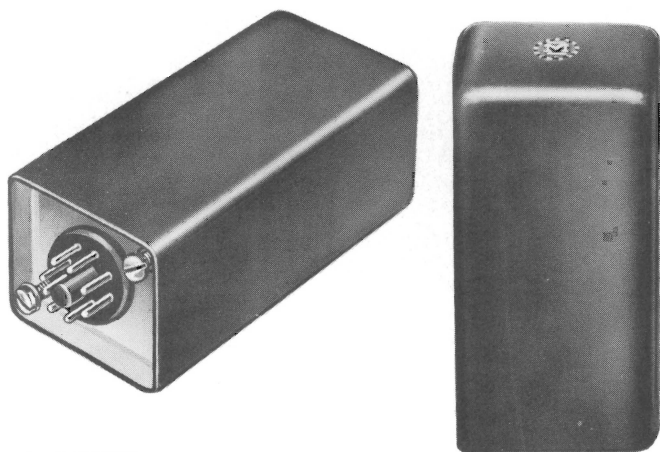
Physical Data: Height — 3 inches

Width — 6 inches

Depth — 9½ inches behind panel Weight — 1½ pounds

Magnetic Shield: Carefully annealed mu-metal

MILLEN NO. 90202 MODULE PLUG-IN HIGH VOLTAGE POWER SUPPLY



FEATURES

Compact
Plug-in
Complete
Encapsulated in Epoxy

Includes CRT Heater Power
Either Polarity
Pi-section Filter

The No. 90202 is a compact power supply for module oscilloscopes. Supplies accelerating and centering potential and heater power for one 90901, 90911, 90912, 90912-R or 90913.

SPECIFICATIONS

Power Output

750 volts d.c. at 3 milliamperes to

1020 volts d.c. at 1.1 milliamperes

6.3 volts a.c. at 0.6 ampere

Power Input

105 to 125 volts 50/60 cycles

Power Consumption — 10 watts

external Fuse — ½ ampere

Ripple Output

Approx. 0.35 per cent

Physical Data

Height — 5 inches

Width — 2½ inches

Depth — 2 inches

Weight — 1¾ pounds



MILLEN BASIC OSCILLOSCOPES

JAMES MILLEN NUMBERS: 90902, 90903, 90905, and 90905-B

TYPICAL APPLICATIONS

Production test
Transistor test
Modulation monitor
Process monitor
Frequency comparator
Null indicator
Mode indicator
Jitter indicator
Neutralization indicator
Output indicator
Phase shift indicator
Linearity monitor
Per cent modulation indicator
Frequency drift indicator

MILLEN BASIC OSCILLOSCOPES are designed for either of two purposes. That is, general laboratory and experimental use in their normal form as complete self-contained oscilloscopes, or else as basic components for actual permanent incorporation into more involved specialized complete equipments.

The **basic** oscilloscopes in their packaged form are entirely adequate for many laboratory as well as industrial and communication uses. As a transmitter modulation monitor, no additional equipment or accessories are required. The well known trapezoidal monitoring patterns are secured by feeding modulated carrier voltage from a pick up loop directly to the vertical plates of the cathode ray tube and audio modulating voltage to the horizontal plates. By addition of such units as sweeps, pulse generators, amplifiers, servo-sweeps, etc., all of which can be conveniently and neatly constructed on companion rack panels, the original basic oscilloscope unit can be expanded to serve nearly all applications. Here the research engineer is freed of the drudgery of such time consuming mechanical construction as mounting the cathode ray tube, providing proper and adequate magnetic shielding, building the high voltage power supply, providing proper safety features, etc., and other such details of the **basic** oscilloscope before being able to proceed with his specialized work.

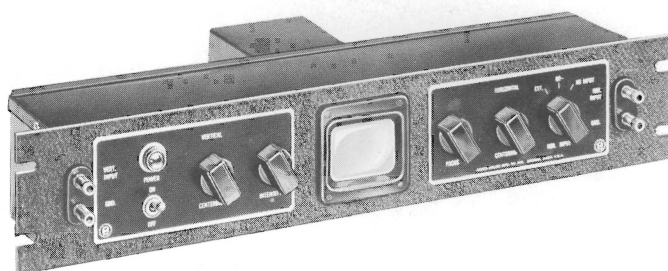
The **MILLEN No. 90921 Amplifier/Sweep** is available for use with any of the **basic** oscilloscopes in applications where standard vertical and horizontal amplifiers and a saw-tooth sweep generator are required.

SPECIFICATIONS

Sensitivity	(With no external amplifier)
Vertical	14 volts r.m.s. per centimeter deflection 39 volts peak to peak per centimeter deflection 35 volts r.m.s. per inch deflection 100 volts peak to peak per inch deflection
Horizontal	17 volts r.m.s. per centimeter deflection 47 volts peak to peak per centimeter deflection 43 volts r.m.s. per inch deflection 120 volts peak to peak per inch deflection
Sensitivity	(Using Millen No. 90921 Amplifier/Sweep)
Vertical	0.38 volt r.m.s. per centimeter deflection 1.1 volts peak to peak per centimeter deflection 0.97 volt r.m.s. per inch deflection 2.7 volts peak to peak per inch deflection
Horizontal	0.61 volt r.m.s. per centimeter deflection 1.7 volts peak to peak per centimeter deflection 1.6 volts r.m.s. per inch deflection 4.4 volts peak to peak per inch deflection
Deflection Type	Single-ended
Power Supply	105-125 volts — 60 cycles Power consumption — 19 watts Fuse size — 1½ amperes Internal d.c. supply voltage — 800 volts Internal accelerating potential — 720 volts
Tube Complement	1 — RCA or GE. 2BP1 or 2BP11 — 2 inch diameter cathode ray tube 1 — 2X2-A high voltage rectifier tube
Panel Controls	Intensity, Focus, Vertical Centering, Horizontal Centering Horizontal Input Selector
Physical Data	Height — 3½ inches Depth — 9¼ inches Width — 19 inches Weight — 12 pounds The oscilloscope mounts in a standard rack
Magnetic Shield	Carefully annealed mu-metal

MILLEN NO. 90902 BASIC OSCILLOSCOPE

TWO INCH ROUND TUBE



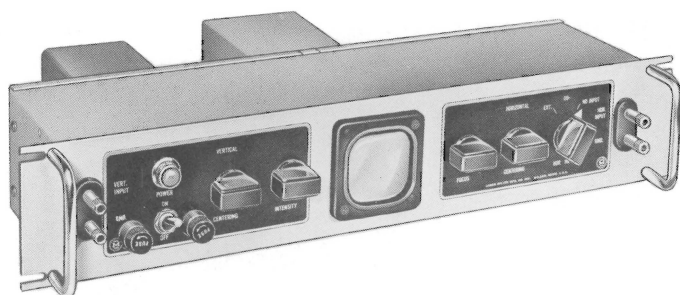
FEATURES

Small — 3½ Inch Panel	No Control Interaction
Inexpensive	Line Frequency Sweep
Rack Panel Mounted	Input Jacks on Front and Rear
Complete with Power Supply	P1 or P11 Phosphor

The **No. 90902** is a basic cathode ray oscilloscope comprised of a 2BP1 or 2BP11 two inch cathode ray tube and its associated circuit and power supply. The No. 90902 has a standard 19 inch rack panel.

MILLEN NO. 90902-M BASIC OSCILLOSCOPE

MILITARY VERSION TWO INCH ROUND TUBE



FEATURES

MIL Specs.	Line Frequency Sweep
Rugged Construction	No Control Interaction
MIL-T-27-A Power Transformer	Complete with Power Supply
Small — 3½ Inch Panel	Input Terminals on
x 19 Inch Rack Panel	Front and Rear

The No. 90902-M is a military version of the standard No. 90902 basic oscilloscope. Design and construction are to meet the intent of military specifications MIL-T-945-A for ground based equipment. Power transformer to MIL-T-27-A.

SPECIFICATIONS

Sensitivity

Vertical 14 volts r.m.s. per centimeter deflection
 39 volts peak to peak per centimeter deflection
 35 volts r.m.s. per inch deflection
 100 volts peak to peak per inch deflection
 Horizontal 17 volts r.m.s. per centimeter deflection
 47 volts peak to peak per centimeter deflection
 43 volts r.m.s. per inch deflection
 120 volts peak to peak per inch deflection

Deflection Type

Single-ended

Power Supply

105-125 volts — 50/1000 cycles
 Power consumption — 19 watts
 Fuse size — 1½ amperes
 Internal d.c. supply voltage — 800 volts
 Internal accelerating potential — 720 volts

Tube Complement

1 — MIL — 2BP1 or 2BP11 —
 2 inch diameter cathode ray tube
 1 — MIL — 2X2-A high voltage rectifier tube

Panel Controls

Intensity, Focus, Vertical Centering, Horizontal Centering
 Horizontal Input Selector

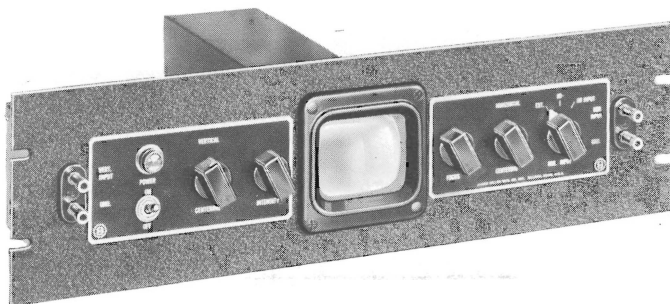
Physical Data

Height — 3½ inches Depth — 9¼ inches
 Width — 19 inches Weight — 12½ pounds
 The oscilloscope mounts in a standard rack

Magnetic Shield Carefully annealed mu-metal

MILLEN NO. 90903 BASIC OSCILLOSCOPE

THREE INCH ROUND TUBE



FEATURES

Complete with Power Supply	Large Display
Horizontal Selector Switch	No Control Interaction
Line Frequency Sine Wave Sweep	Good Definition
Input Terminals on Front and Rear	Rack Mounted
	Light Filter

The No. 90903 is a basic cathode ray oscilloscope comprised of a 3KP1, 3KP4, 3KP7, or 3KP11 three inch cathode ray tube and its associated circuit and power supply. The No. 90903 has a standard 19 inch rack panel.

SPECIFICATIONS

Sensitivity

(With no external amplifier)

Vertical 4.4 to 5.5 volts r.m.s. per centimeter deflection
 12 to 16 volts peak to peak per centimeter deflection
 11 to 14 volts r.m.s. per inch deflection
 31 to 40 volts peak to peak per inch deflection
 Horizontal 5.8 to 6.3 volts r.m.s. per centimeter deflection
 16 to 18 volts peak to peak per centimeter deflection
 15 to 16 volts r.m.s. per inch deflection
 42 to 46 volts peak to peak per inch deflection

Sensitivity

(Using Milken No. 90921 Amplifier/Sweep)

Vertical 0.19 volt r.m.s. per centimeter deflection
 0.55 volt peak to peak per centimeter deflection
 0.49 volt r.m.s. per inch deflection
 1.4 volts peak to peak per inch deflection
 Horizontal 0.25 volt r.m.s. per centimeter deflection
 0.71 volt peak to peak per centimeter deflection
 0.64 volt r.m.s. per inch deflection
 1.8 volts peak to peak per inch deflection

Deflection Type

Single-ended

Power Supply

105-125 volts — 60 cycles
 Power consumption — 19 watts
 Fuse size — 1 ampere
 Internal d.c. supply voltage — 800 volts
 Internal accelerating potential — 720 volts

Tube Complement

1 — RCA or GE. 3KP1, 3KP4, 3KP7, or 3KP11 —
 3 inch diameter cathode ray tube
 1 — 2X2-A high voltage rectifier tube

Panel Controls

Intensity, Focus, Vertical Centering, Horizontal Centering
 Horizontal Input Selector

Physical Data

Height — 5¼ inches Depth — 13½ inches
 Width — 19 inches Weight — 14 pounds
 The oscilloscope mounts in a standard rack

Magnetic Shield Carefully annealed mu-metal

MILLEN BASIC OSCILLOSCOPES

JAMES MILLEN NUMBERS: 90902, 90903, 90905, and 90905-B

TYPICAL APPLICATIONS

Production test
Transistor test
Modulation monitor
Process monitor
Frequency comparator
Null indicator
Mode indicator
Jitter indicator
Neutralization indicator
Output indicator
Phase shift indicator
Linearity monitor
Per cent modulation indicator
Frequency drift indicator

MILLEN BASIC OSCILLOSCOPES are designed for either of two purposes. That is, general laboratory and experimental use in their normal form as complete self-contained oscilloscopes, or else as basic components for actual permanent incorporation into more involved specialized complete equipments.

The **basic** oscilloscopes in their packaged form are entirely adequate for many laboratory as well as industrial and communication uses. As a transmitter modulation monitor, no additional equipment or accessories are required. The well known trapezoidal monitoring patterns are secured by feeding modulated carrier voltage from a pick up loop directly to the vertical plates of the cathode ray tube and audio modulating voltage to the horizontal plates.

By addition of such units as sweeps, pulse generators, amplifiers, servo-sweeps, etc., all of which can be conveniently and neatly constructed on companion rack panels, the original basic oscilloscope unit can be expanded to serve nearly all applications. Here the research engineer is freed of the drudgery of such time consuming mechanical construction as mounting the cathode ray tube, providing proper and adequate magnetic shielding, building the high voltage power supply, providing proper safety features, etc., and other such details of the **basic** oscilloscope before being able to proceed with his specialized work.

The **MILLEN No. 90921 Amplifier/Sweep** is available for use with any of the **basic** oscilloscopes in applications where standard vertical and horizontal amplifiers and a saw-tooth sweep generator are required.

SPECIFICATIONS

Sensitivity	(With no external amplifier)
Vertical	6.0 to 7.5 volts r.m.s. per centimeter deflection 17 to 21 volts peak to peak per centimeter deflection 15 to 19 volts r.m.s. per inch deflection 43 to 54 volts peak to peak per inch deflection
Horizontal	7.5 to 9.1 volts r.m.s. per centimeter deflection 21 to 26 volts peak to peak per centimeter deflection 19 to 23 volts r.m.s. per inch deflection 54 to 65 volts peak to peak per inch deflection
Sensitivity	(Using Millen No. 90921 Amplifier/Sweep)
Vertical	0.25 to 0.28 volt r.m.s. per centimeter deflection 0.70 to 0.79 volt peak to peak per centimeter deflection 0.63 to 0.71 volt r.m.s. per inch deflection 1.8 to 2.0 volts peak to peak per inch deflection
Horizontal	0.29 to 0.33 volt r.m.s. per centimeter deflection 0.83 to 0.93 volt peak to peak per centimeter deflection 0.63 to 0.71 volt r.m.s. per inch deflection 1.8 to 2.0 volts peak to peak per inch deflection
Maximum Undistorted Deflection	(Using centering controls to keep desired portion of signal on the cathode ray tube face) Vertical — 7 inches Horizontal — 6½ inches
Deflection Type	Single-ended
Power Supply	105-125 volts — 50/60 cycles Power consumption — 32 watts Fuse Size — 1 ampere Internal accelerating potential: 2050 volts
Tube Complement	1 — RCA or GE. 5UP1, 5UP7 or 5UP11 5 in cathode ray tube 1 — 2X2-A — Negative high voltage rectifier tube 1 — 5Y3-GT — Positive high voltage rectifier tube
Panel Controls	Intensity, Focus, Vertical Centering, Horizontal Centering, and Horizontal Input Selector
Physical Data	The oscilloscope mounts in a standard 19 inch rack Height — 6½ inches Depth — 16½ inches overall Width — 19 inches Weight — 24 pounds
Magnetic Shield	Carefully annealed mu-metal

MILLEN NO. 90905 BASIC OSCILLOSCOPE

FIVE INCH ROUND TUBE



FEATURES

Rack Mounted
Complete with Power Supply
Includes Power Supply
for Accessories
Good Definition
Light Filter
High Accelerating Potential

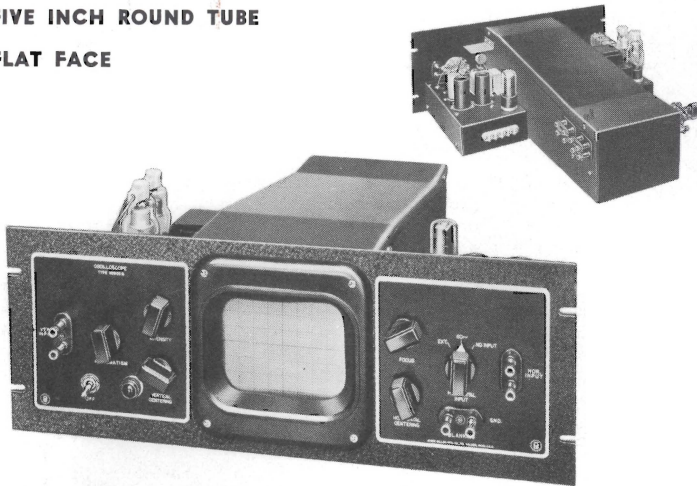
Line Frequency Sine
Wave Sweep
Horizontal Input Selector
No Control Interaction
Rugged Construction
Input Terminals Front
and Rear

The **No. 90905** is a general purpose basic cathode ray oscilloscope using a five inch diameter type 5UP1, 5UP7 or 5UP11 cathode ray tube. The No. 90905 is complete with all components necessary for a high quality general purpose oscilloscope but does not include accessories for special purpose applications.

MILLEN NO. 90905-B BASIC OSCILLOSCOPE

FIVE INCH ROUND TUBE

FLAT FACE



FEATURES

Balanced Deflection
Astigmatism Control
Blanking Input Terminals
Flat Face Precision
Tolerance Tube

Sharp Focus
Accelerating Potential
1800 or 2500 volts
Rack Mounting
Power Supply for Accessories

The No. 90905-B is a precision general purpose basic cathode ray oscilloscope designed for rack mounting. It has balanced deflection and provisions for blanking, and uses the precision tolerance type 5ADP1, 5ADP2, 5ADP7 or 5ADP11 cathode ray tube.

SPECIFICATIONS

Sensitivity (With no external amplifier)

Accelerating Potential — 1800 volts

Vertical..... 4.0 to 4.6 volts r.m.s. per centimeter deflection
11 to 13 volts peak to peak per centimeter deflection
10 to 12 volts r.m.s. per inch deflection
29 to 33 volts peak to peak per inch deflection
Horizontal..... 5.5 to 6.0 volts r.m.s. per centimeter deflection
16 to 17 volts peak to peak per centimeter deflection
14 to 15 volts r.m.s. per inch deflection
40 to 43 volts peak to peak per inch deflection

Accelerating Potential — 2500 volts

Vertical..... 4.8 to 6.1 volts r.m.s. per centimeter deflection
14 to 17 volts peak to peak per centimeter deflection
12 to 16 volts r.m.s. per inch deflection
35 to 44 volts peak to peak per inch deflection
Horizontal..... 6.9 to 7.4 volts r.m.s. per centimeter deflection
19 to 21 volts peak to peak per centimeter deflection
16 to 19 volts r.m.s. per inch deflection
46 to 53 volts peak to peak per inch deflection

Sensitivity (Using Milken No. 90921 Amplifier/Sweep)

Accelerating Potential — 1800 volts

Vertical..... 0.17 to 0.19 volt r.m.s. per centimeter deflection
0.47 to 0.53 volt peak to peak per centimeter deflection
0.42 to 0.47 volt r.m.s. per inch deflection
1.2 to 1.3 volts peak to peak per inch deflection
Horizontal..... 0.26 to 0.28 volt r.m.s. per centimeter deflection
0.75 to 0.80 volt peak to peak per centimeter deflection
0.67 to 0.72 volt r.m.s. per inch deflection
1.9 to 2.0 volts peak to peak per inch deflection

Blanking Sensitivity: 14 to 40 volts peak

Power Supply: 105-125 volts — 50/60 cycles

Power Consumption — 35 watts

Fuse Size — 1 ampere

Internal accelerating Potential — 1800 or 2500 volts

Tube Complement

1 — RCA 5ADP1, 5ADP2, 5ADP7, or 5ADP11 5 in. cath. ray tube
2 — 2X2-A High voltage rectifier tubes
1 — 5Y3-GT Positive voltage rectifier tube

Panel Controls Intensity, Focus, Vertical Centering, Horizontal Centering, Astigmatism and Horizontal Input Selector

Physical Data: The oscilloscope mounts in a standard 19 inch rack
Height — 6 1/4 inches Depth — 18 1/2 inches behind panel
Width — 19 inches Weight — 37 pounds

Magnetic Shield: Carefully annealed mu-metal

MILKEN NO. 90921 AMPLIFIER/SWEEP



FEATURES

Front Panel Input Internal Power Supply
Rear Panel Output Matches Milken Basic Oscilloscopes
Universal: May be used with any basic or module oscilloscope
Provisions to use external plate supply voltage for greater output voltage when needed

The No. 90921 Amplifier/Sweep is an accessory which may be used with any basic or module oscilloscope. It contains a vertical amplifier, a horizontal amplifier, and a sweep generator. The No. 90921 has a built in power supply and provisions for using the higher plate supply voltage made available in the five inch basic oscilloscopes.

SPECIFICATIONS

Frequency Response Vertical..... 15 cycles to 125 KC \pm 2db
Horizontal..... 15 cycles to 125 KC \pm 2db

Gain Vertical..... 24 Horizontal..... 24

Maximum Undistorted Output Voltage

Internal Plate Supply 70 volts peak to peak

Plate Supply from No. 90905 or 90905-B Basic Oscilloscopes
380 volts peak to peak. (Enough for 7 inches vertical deflection on No. 90905 Basic Oscilloscope)

Sensitivity With Basic Oscilloscopes

90902 Vertical..... 0.38 volt r.m.s. per centimeter deflection
Horizontal..... 0.61 volt r.m.s. per centimeter deflection

90903 Vertical..... 0.19 volt r.m.s. per centimeter deflection
Horizontal..... 0.25 volt r.m.s. per centimeter deflection

90905 Vertical..... 0.25 to 0.28 volt r.m.s. per centimeter deflection
Horizontal..... 0.29 to 0.33 volt r.m.s. per centimeter deflection

90905-B Vertical..... 0.17 to 0.19 volt r.m.s. per centimeter deflection
Horizontal..... 0.26 to 0.28 volt r.m.s. per centimeter deflection

Sweep Type: Hard Tube

Range: 15 cycles to 40 kilocycles

Synchronization: Internal Line Frequency External

Power Supply 105-125 volts — 60 cycles

Power Consumption — 32 watts

Fuse Size — 1 ampere

Tube Complement

1-6SJ7 Vertical Amplifier Tube 1-5Y3-GT
1-6SJ7 Horizontal Amplifier Tube Rectifier Tube
1-6SN7-GT Sweep Generator Tube

Controls Vertical Gain, Horizontal Gain, Coarse Sweep Frequency, Fine Sweep Frequency, Sync. Gain, Horizontal Select, Power On-Off, Sync. Select

Physical Data Height — 5 1/4 inches Depth — 8 3/8 inches overall
Width — 19 inches Weight — 13 pounds

The No. 90921 Amplifier/Sweep mounts in a standard 19 inch rack

JAMES MILLEN OSCILLOSCOPES



SPECIFICATIONS

Frequency Response

Vertical..... 7 cycles to 125 KC ± 2 db

Horizontal..... 2 cycles to 125 KC ± 2 db

Sensitivity

Vertical..... 0.12 volt r.m.s. per centimeter deflection
0.35 volt peak to peak per centimeter deflection
0.31 volt r.m.s. per inch deflection
0.88 volt peak to peak per inch deflection

Horizontal..... 0.14 volt r.m.s. per centimeter deflection
0.40 volt peak to peak per centimeter
0.36 volt r.m.s. per inch deflection
1.02 volts peak to peak per inch deflection

Sweep:

Type: 6Q5-G gas tube
Range: 2 cycles per second to 30 KC per second
Synchronization: Internal Line External

Deflection Type:

Balanced

Power Supply

105 to 125 volts — 50/60 cycles
Fuse Size — 1 ampere
Internal accelerating potential of 2040 volts permits use of P1, P2, P7 or P11 screens

Tube Complement

- 1 — Waterman or DuMont 3XP1, 3XP2, 3XP7 or 3XP11
3 X 1 1/2 inch rectangular face cathode ray tube
- 1 — 12AU7-A Vertical amplifier tube
- 1 — 12AU7-A Horizontal amplifier tube
- 1 — 6Q5-G Sweep generator gas tube
- 1 — 2X2-A High voltage rectifier tube
- 1 — 5Y3-GT Low voltage rectifier tube

Panel Controls

Intensity, Focus, Vertical Centering, Horizontal Centering, Vertical Gain, Fine Frequency, Coarse Frequency, Sync. Gain, Sync. Select., Horizontal Gain, Horizontal Select.

Physical Data:

Oscilloscope mounts in a standard 19 inch rack
Height — 3 1/2 inches
Width — 19 inches
Depth — 11 inches behind panel
Weight — 19 pounds

Magnetic Shield:

Carefully annealed mu-metal

"Designed for Performance"®

MILLEN NO. 90923 RACK MOUNTED OSCILLOSCOPE

3 x 1 1/2 INCH RECTANGULAR TUBE
COMPLETE WITH AMPLIFIERS AND SWEEP

FEATURES

Extremely Compact - 3 1/2" High
Complete
Linear Sweep
Low Frequency Sweep

Balanced Deflection
High Accelerating Potential
Rack Mounting
Large Rectangular Display

The No. 90923 oscilloscope is an extremely compact (3 1/2 inches high) rack panel general purpose oscilloscope utilizing the type 3XP— 3 X 1 1/2 inch rectangular face tube. The No. 90923 is complete with vertical and horizontal amplifiers for balanced deflection and a very linear sweep generator.

Miniature input terminals are on both the front panel and the rear for vertical amplifier input, horizontal amplifier input and synchronizing input. The linear sweep generator covers two cycles per second to 30 kcs. per second in seven overlapping ranges. The trace is unusually sharp and bright due to 2040 volts accelerating potential.

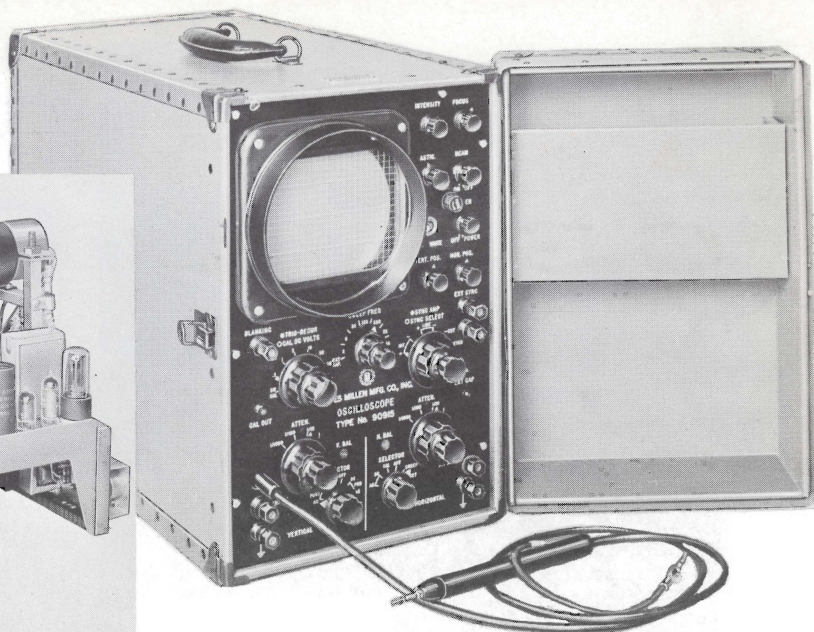
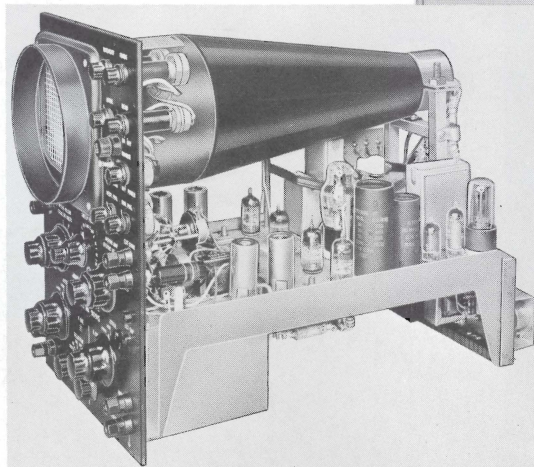
The No. 90923 is ideally suited for many applications, and in particular, for production test. Its small panel uses up very little space in a test rack and the mu-metal shield around the cathode ray tube shields it against magnetic fields so that the oscilloscope may be used accurately in locations with strong stray magnetic fields. The cathode ray tube is of the mono-accelerator type in which the electron beam is accelerated at the electron gun so that field distortions are minimized and excellent deflection linearity is achieved as well as a very uniform spot size over the entire area which the beam scans.

MILLEN No. 90915 INDUSTRIAL OSCILLOSCOPE

FIVE INCH ROUND
TUBE FLAT FACE

FEATURES

- Completely Insulated Double Magnetic Shield
- Sharp Focus
- 4" x 4" Useful Scan
- Identical Stable D.C. Amplifiers
- No Phase Error
- Precision Tolerance Flat Face Tube
- Frequency Response D.C. to 100 KC. $\pm 0 - 10\%$



The **MILLEN No. 90915** Industrial Oscilloscope is suitable for use in factory, laboratory and the field for design, installation, maintenance and service. It has a completely insulated front panel and case, a double shield against magnetic fields, excellent linearity, and sharp focus over the entire 4" x 4" useful scan. The vertical and horizontal amplifiers are

SPECIFICATIONS

Frequency Response Vertical Amplifier or Horizontal Amplifier

D.C. Amplifier using either the terminals or the probe and at any gain setting
 0 to 100 KC. $\pm 0 - 10\%$
 0 to 200 KC. $\pm 0 - 30\%$
 0 to 400 KC. $\pm 0 - 50\%$

Square Wave Response 0 to 10 KC.

A.C. Amplifier using either the terminals or the probe and at any gain setting

Same as d.c. amplifier except low frequency 3db. point is 0.3 cycles

Square Wave Response 30 cycles to 10 KC.

Sensitivity

Vertical Amplifier

Terminals D.C. 0.30 volt d.c. per inch deflection
 A.C. 0.12 volt peak to peak per centimeter deflection
 0.30 volt peak to peak per inch deflection

Probe..... D.C. 3.0 volts d.c. per inch deflection
 A.C. 1.2 volts peak to peak per centimeter deflection
 3.0 volts peak to peak per inch deflection

Horizontal Amplifier

D.C. 0.43 volt d.c. per inch deflection
 A.C. 0.17 volt peak to peak per centimeter deflection
 0.43 volt peak to peak per inch deflection

Sensitivity

Direct to deflection plates

Capacity 15pf. each plate to ground

Vertical..... D.C. 27 to 33 volts d.c. per inch deflection
 A.C. 10 to 13 volts peak to peak per centimeter deflection
 27 to 33 volts peak to peak per inch deflection

Horizontal D.C. 34 to 42 volts d.c. per inch deflection
 A.C. 13 to 17 volts peak to peak per centimeter deflection
 34 to 42 volts peak to peak per inch deflection

Maximum Input Potential

Horizontal amplifier or vertical amplifier
 1500 volts peak to peak
 550 volts r.m.s.

Input Impedance

Horizontal amplifier or vertical amplifier
 Probe — 10 megohms and 13 pf.
 Terminals — 5 megohms and 45 pf.

Linearity

Horizontal amplifier or vertical amplifier
 Less than 5% non-linearity

Positioning

Vertical amplifier — At least 2.7 tube diameters
 Horizontal amplifier — At least 1.7 tube diameters

Phase Shift Between Amplifiers

With like gain and attenuator settings, there is no appreciable phase shift at frequencies up to 1 megacycle
 With one amplifier adjusted with vernier gain at $\frac{1}{2}$ and the other at maximum (worst possible condition) phase shifts are:

1.3 degrees at 30 KC 2.8 degrees at 100 KC 14 degrees at 500 KC

stable d.c. amplifiers and are identical, thus permitting accurate phase measurements to 1 mc. with no phase correction necessary. The No. 90915 uses the type 5AQP1, 2, 7 or 11 flat face, precision tolerance cathode ray tube. The frequency response of either amplifier is d.c. to 100 KC $\pm 0 - 10\%$.

Amplitude Calibration

0.3, 1.0, 3.0, 10, 30, and 100 volts d.c. $\pm 4\%$ (regardless of line voltage) available to either amplifier through panel switch and also available at a jack on the panel

Sample Line Voltage

Available to both vertical and horizontal amplifiers through panel switching

Type: 6Q5-G gas tube

Range: 2 cycles per second to 30 KC per second with provisions for adding external capacity for slower sweeps

Synchronization: Internal positive going
 Internal negative going
 Line positive going
 Line negative going
 External positive going
 External negative going
 Keyed

Synchronizing voltage is applied through a limiter

Blanking

Input impedance: 3.3 megohms and 70 pf
 Input voltage: —20 volts peak to blank
 Blanking input terminals: Front panel

Power Supply

105 to 125 volts 50/60 cycles or
 210 to 250 volts 50/60 cycles
 Power consumption 105 watts
 Internal accelerating potential of 2100 volts permits use of P1, P7, or P11 screens

Ambient Temperature Range

0 to 50 degrees centigrade

Tube Complement

- 1 — DuMont 5AQP — 1, 7, or 11 5 inch diameter flat face precision tolerance cathode ray tube
- 2 — G. E. 5 Star 5814-A Amplifier input tubes
- 2 — G. E. 5 Star 6201 Differential amplifier tubes
- 2 — 6BK7-A Amplifier output tubes
- 1 — 12AT7 Synchronizing voltage amplifier and sweep voltage clamp tube
- 1 — DuMont 6Q5-G Sweep generator tube
- 1 — 12AU7-A Sweep cathode follower and blanking amplifier tube
- 1 — 1B3-GT High voltage rectifier tube
- 1 — 5Y3-GT Low voltage rectifier tube
- 1 — 6AQ5 Series voltage regulator tube
- 1 — 6AU6 Voltage regulator control tube
- 1 — 0A2 Voltage reference tube
- 2 — 1N48 Crystal rectifiers for synchronizing voltage limiters
- 2 — 1N91 Crystal rectifiers for line frequency synchronizing voltage limiters

Physical Data

Height 15 $\frac{1}{4}$ inches including handle Width 10 inches
 Depth 22 $\frac{1}{8}$ inches overall Weight 40 pounds

Magnetic Shield Carefully annealed double shield of nicoloi and mu-metal

SPECIFICATIONS

Frequency Response of Vertical Amplifier

10 cycles to 450 kc ± 0.5 db.
10 cycles to 1 mc. ± 3 db.

Sensitivity

Vertical..... 0.14 volt r.m.s. per centimeter deflection
0.39 volt peak to peak per centimeter deflection
0.35 volt r.m.s. per inch deflection
1.0 volt peak to peak per inch deflection

Input Attenuator Six positions 1, 3, 10, 30, 100, 300 volts peak to peak per inch deflection

Calibrator 10 volts peak to peak calibration signal available

Synchroscope Sweep

6 fast sweeps from 6 microseconds per inch to 304 microseconds per inch (2.4 microseconds per centimeter to 120 microseconds per centimeter.)

Synchroscope Synchronization

Internal — Positive or Negative
External — Positive or Negative
Internal synchronizing pulses available at panel

Oscilloscope Sweep

Type: 6D4 gas tube
Range: 16 cycles to 22 kc. in 9 overlapping ranges
Synchronization: Internal Line External

Power Supply: 105-125 volts — 60 cycles
Power Consumption — 45 watts

Tube Complement

- 1 — RCA or GE 2BP1 or 2BP11 two inch cathode ray tube
- 1 — 6AK5 — Vertical deflection video amplifier tube
- 1 — 6AG7 — Vertical deflection video amplifier tube
- 1 — 6D4 — Sawtooth sweep voltage generator gas tube
- 1 — 6SN7-GT — Fast synchroscope sweep generator tube
- 1 — 6SN7-GT — Pulse generator and trigger output tube
- 1 — 6SN7-GT — Pulse modifier and blanking pulse tube
- 1 — 6X5-GT — Low voltage rectifier tube
- 1 — 1Z2 — High voltage rectifier tube

Controls

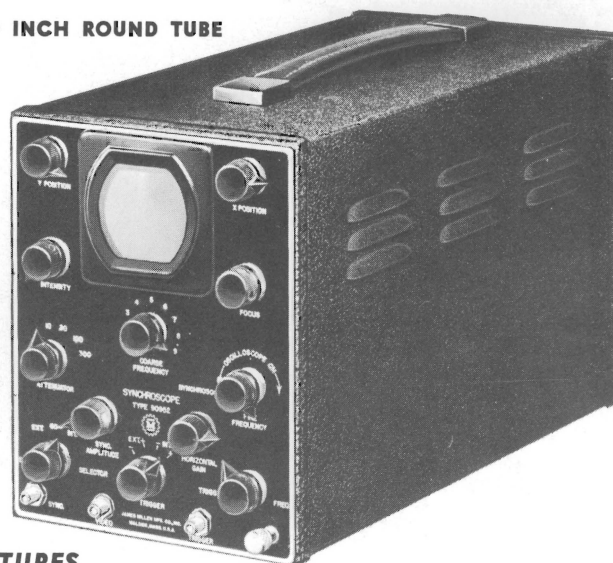
Intensity, Focus, Y Position, X Position, Vertical Attenuator, Coarse Frequency, Synchroscope/Oscilloscope Switch, Fine Frequency, Sync. Amplitude, Horizontal Gain, Sync. Selector, Trigger Selector, Trigger Rep. Rate.

Physical Data Height (including handle) 7 1/2 inches Width 5 1/2 inches
Depth (including knobs) 13 inches Weight 17 3/4 pounds

Magnetic Shield: Carefully annealed mu-metal

MILLEN NO. 90952 MINIATURE SYNCHROSCOPE/OSCILLOSCOPE

TWO INCH ROUND TUBE



FEATURES

Miniature
Light Weight
Synchroscope Sweeps
Internal Pulse Generator

Convenient Sweep Synchronization
Sensitive
Calibrated Input Attenuator
Wide Band Amplifier

The No. 90952 Synchroscope/Oscilloscope is a compact "field service" instrument which weighs only 17 pounds. Performance has not been sacrificed in designing this unit for light weight.

FEATURES

Complete
Envelope or
Trapezoidal Display
A-M or SSB
Blanks Out on Standby
3.5 to 54 mc
Individual Coil for
each Amateur Band
Light Filter

SPECIFICATIONS

Cathode Ray Tube — 2BP1

Blanking

Automatic or Manual

Horizontal Width

Controlled by attenuator

Phase

Phase errors of connections may be corrected by control on panel

Display

Envelope — Line frequency sine wave sweep
Trapezoid — External input to horizontal attenuator

Frequency

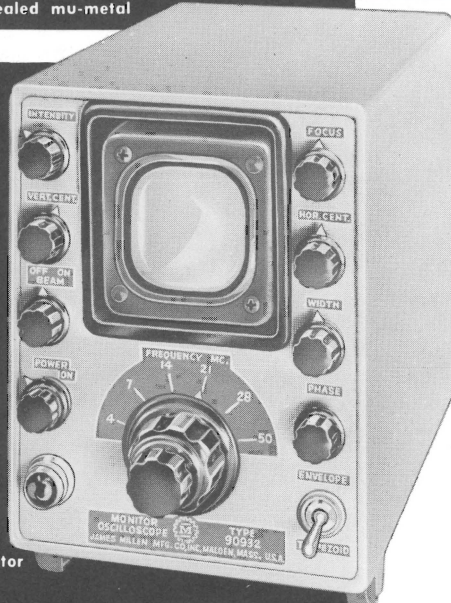
6 bands — separate coil for each band. 4, 7, 14, 21, 28, 50 mc. Tuning capacitor to adjust vertical deflection

Vertical Input

Link-coupled pick-up loop to be loosely coupled to modulated r-f output of transmitter

Sensitivity

Usable vertical deflection when pick-up loop is coupled to a low power source such as a Grid Dip Meter.



MILLEN NO. 90932 MODULATION MONITOR OSCILLOSCOPE

TWO INCH ROUND TUBE

The No. 90932 Amateur Band Monitor Oscilloscope is a complete oscilloscope for monitoring the modulated r-f output of a transmitter. Built-in link-coupled tuned circuits cover all amateur bands 3.5 to 54 mc. All circuits and accessories are built in. The monitor will display the r-f envelope and/or the trapezoidal monitoring pattern of single side band transmitters or amplitude modulated transmitters. It shows the linearity or non-linearity of Class-B r-f amplifiers, the keying characteristic of c-w transmitters, parasitic oscillation, neutralization, and r-f output. The cathode ray beam responds instantly and provides the information that moving coil meters can never provide. In addition, it provides a continuous complete picture of the overall performance of the transmitter. A cathode ray monitor is an absolute necessity to assure proper operation of a single side band linear r-f amplifier.

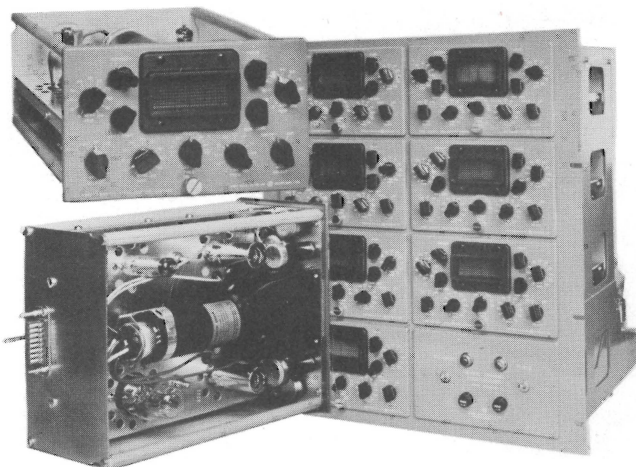
The two inch diameter cathode ray tube provides a large display of envelope, trapezoid and bow-tie patterns.

For trapezoidal display, the horizontal deflection signal is taken from the modulator output.

The overall power supply voltage is 1040 volts dc which is high enough to provide a very sharply focused trace with good intensity, and still low enough to provide excellent deflection sensitivity. The beam is blanked during standby, by the operation of a 6.3 volt relay which is controlled by the station master send/receive switch or VOX relay. The high voltage rectifier consists of two selenium stacks to aid compactness and eliminate a rectifier tube and its attendant heat.

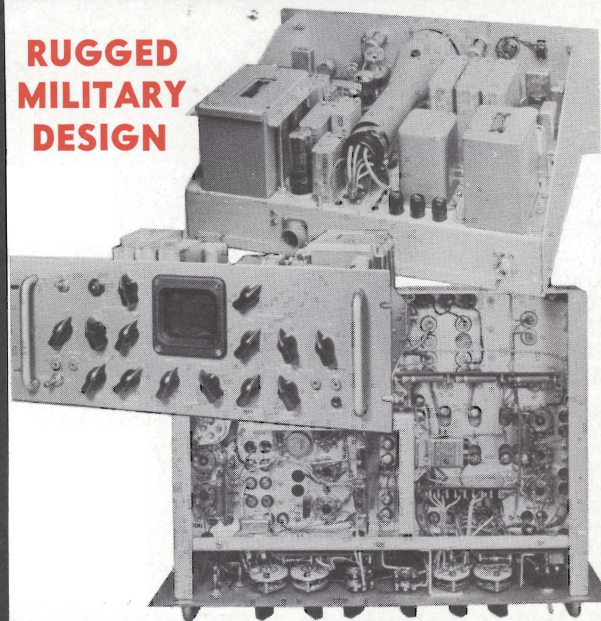
Low voltage r-f is picked up from any convenient point on the transmitter output by means of a small single turn coil. This coil may be loosely coupled to the transmitter output circuit, the antenna matching circuit or any other convenient point in the output circuit.

SPECIAL DESIGN OSCILLOSCOPES

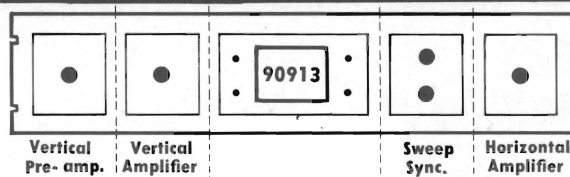


Illustrated is one example of the use of the Millen Module concept in the design of a multi-oscilloscope monitoring assembly. Each plug-in module is a complete and independent oscilloscope containing vertical and horizontal dc amplifiers and sweep. All oscilloscopes use one common power supply.

**RUGGED
MILITARY
DESIGN**

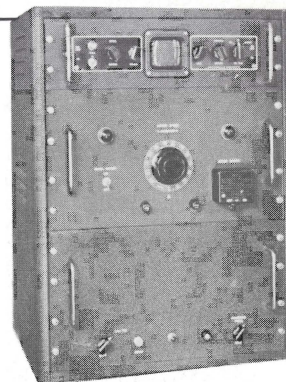


JAMES MILLEN MFG. CO., INC. • 150 Exchange St., Malden, Mass.



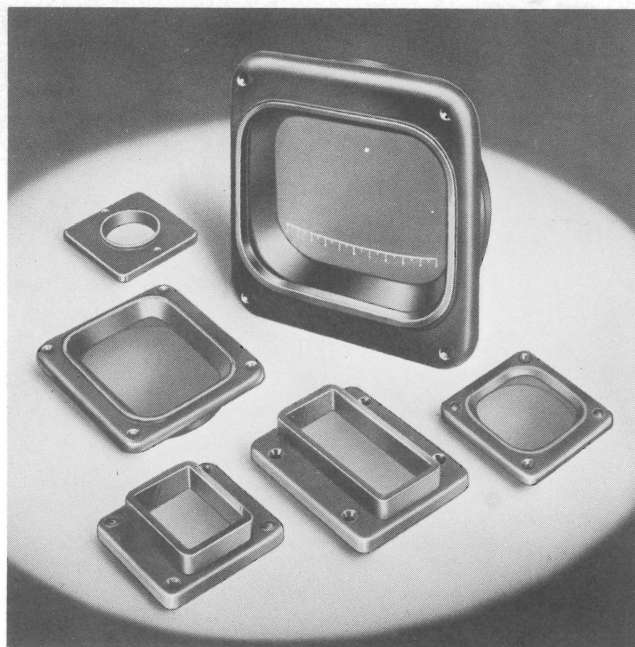
MILLEN ADD-ON MODULES

The line drawing illustrates another expansion on the Millen Module concept. It shows a No. 90913 Module Oscilloscope with provisions for adding amplifier and sweep modules as required by the application. No. 90202 High Voltage Power Supply and low voltage power supplies are added as required.



Illustrated is but one of the many complete equipments built using the standard Basic Oscilloscopes or a special electrical design as required by the application.

JAMES MILLEN



"Designed for Performance"®

MILLEN BEZELS FOR CATHODE RAY TUBES

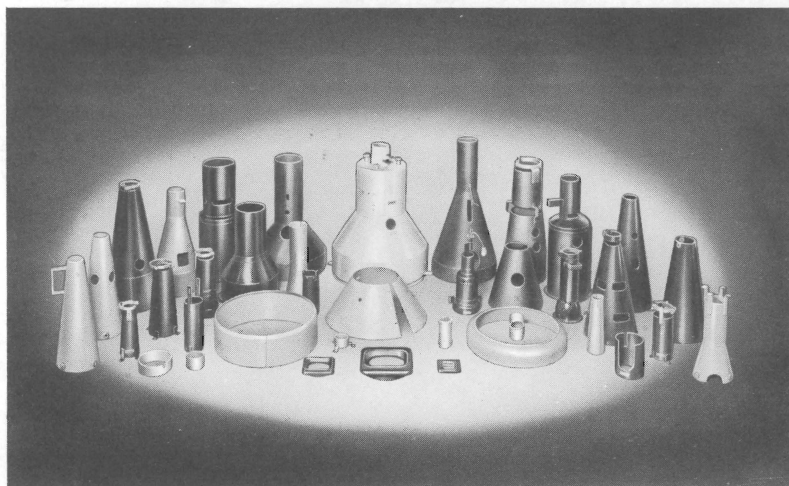
The **MILLEN** line of accessories for cathode ray oscilloscopes includes a complete and extensive line of bezels for use with nearly all types of cathode ray tubes. Bezel material is molded phenolic or cast aluminum. All bezels have a black satin finish. Tube mount cushions are supplied to fit standard round tubes, flat face round tubes, and rectangular tubes. For special applications, bezels are molded of high impact strength phenolic. Special applications include camera mount, hooded, light shield, illuminated graticule, etc. Light filter and calibrated graticule furnished with most bezels. Mounted by means of Phillips-head screws. Illuminated bezels include provisions for eight sockets so that each of the four corners of the graticule may be illuminated by either of two colors selected by a panel switch. Standard bezels fit the standard curved face cathode ray tubes. The back rings fit into a hole in the panel.

Catalog Number	Tube Size	Feature	Typical Tube	Material	Viewing Face Opening Shape	Viewing Face Opening Dimensions	Outside Dimensions	Cushion Type	Illuminated	Back Ring
80071	1 in.	Miniature	1CP1	Buterate	Round	1$\frac{7}{32}$ Dia.	2 $\frac{3}{8}$ x 2 $\frac{3}{8}$	None	No	No
80071-B	1 $\frac{1}{4}$ in.	Miniature	1EP1	Buterate	Round	1.272 Dia.	2 $\frac{3}{8}$ x 2 $\frac{3}{8}$	None	No	No
80072	2 in.	Standard	2BP1	Phenolic	Square	1$\frac{3}{4}$ x 1$\frac{3}{4}$	2 $\frac{5}{8}$ x 2 $\frac{5}{8}$	Standard	No	Yes
80072-B	2 in.	Small	2BP1	Aluminum and Steel	Rectangular	1$\frac{3}{4}$ x 1$\frac{3}{8}$	2 $\frac{5}{8}$ x 2 $\frac{5}{8}$	Felt	No	Yes
80073	3 in.	Standard	3RP1	Phenolic	Rectangular	2$\frac{1}{2}$ x 2$\frac{1}{8}$	3 $\frac{5}{8}$ x 3 $\frac{5}{8}$	Standard	No	Yes
80073-B	3 in.	Aluminum	3RP1	Aluminum	Rectangular	2$\frac{1}{2}$ x 2$\frac{1}{8}$	3 $\frac{5}{8}$ x 3 $\frac{5}{8}$	Standard	No	Yes
80073-C	3 in.	Flat Face	3RPT-A	Aluminum	Rectangular	2$\frac{1}{2}$ x 2$\frac{1}{8}$	3 $\frac{5}{8}$ x 3 $\frac{5}{8}$	Neoprene	No	Yes
80073-D	3 in.	High Impact	3RP1	Fiberite	Rectangular	2$\frac{1}{2}$ x 2$\frac{1}{8}$	3 $\frac{5}{8}$ x 3 $\frac{5}{8}$	Standard	No	Yes
80173-A	1 $\frac{1}{8}$ x 2 $\frac{1}{8}$	Rectangular	3UP1	Phenolic	Rectangular	1$\frac{3}{4}$ x 1$\frac{1}{8}$	2 $\frac{3}{8}$ x 2 $\frac{3}{8}$	Flat Neoprene	No	No
80173-B	1 $\frac{1}{2}$ x 3	Rectangular	3XP1	Phenolic	Rectangular	2$\frac{3}{4}$ x 1$\frac{1}{8}$	2 $\frac{1}{2}$ x 3 $\frac{1}{4}$	Flat Neoprene	No	No
80075	5 in.	Standard	5UP1	Phenolic	Rectangular	4$\frac{1}{4}$ x 3$\frac{3}{8}$	6 $\frac{1}{8}$ x 6 $\frac{1}{8}$	Standard	No	Yes
80075-A	5 in.	Aluminum	5UP1	Aluminum	Rectangular	4$\frac{1}{4}$ x 3$\frac{3}{8}$	6 $\frac{1}{8}$ x 6 $\frac{1}{8}$	Standard	No	Yes
80075-B	5 in.	Flat Face	5ADP1	Phenolic	Rectangular	4$\frac{7}{8}$ x 3$\frac{3}{4}$	6 $\frac{1}{8}$ x 6 $\frac{1}{8}$	Flat Face	No	Yes
80075-C	5 in.	Camera Mount	5ADP1	Aluminum	Rectangular	4$\frac{7}{8}$ x 3$\frac{3}{4}$	6 $\frac{1}{4}$ x 6 $\frac{1}{4}$	Flat Face	No	Yes
80075-D	5 in.	High Impact	5UP1	Fiberite	Rectangular	4$\frac{1}{4}$ x 3$\frac{3}{8}$	6 $\frac{1}{8}$ x 6 $\frac{1}{8}$	Standard	No	Yes
80075-E	5 in.	Camera Mount	5ADP1	Aluminum	Rectangular	4$\frac{7}{8}$ x 3$\frac{3}{4}$	6 $\frac{1}{8}$ x 6 $\frac{1}{8}$	None	Yes	No
80075-F	5 in.	Light Shield	5UP1	Aluminum	Round	4$\frac{3}{4}$ Dia.	6 $\frac{1}{8}$ x 6 $\frac{1}{8}$	None	Yes	Yes
80075-G	5 in.	Camera Mount	5UP1	Aluminum	Round	4$\frac{3}{4}$ Dia.	6 $\frac{1}{8}$ x 6 $\frac{1}{8}$	Standard	Yes	No
80075-H	5 in.	Camera Mount	5UP1	Steel	Round	5$\frac{1}{8}$ Dia.	6 $\frac{5}{8}$ Dia.	None	Yes	No
80075-J	5 in.	Camera Mount	5UP1	Aluminum	Rectangular	4$\frac{7}{8}$ x 3$\frac{3}{4}$	6 $\frac{1}{4}$ x 6 $\frac{1}{4}$	Standard	Yes	Yes
80075-K	5 in.	Camera Mount	5ADP1	Aluminum	Rectangular	4$\frac{1}{4}$ x 3$\frac{3}{8}$	6 $\frac{1}{8}$ x 6 $\frac{1}{8}$	Flat Face	No	Yes
80075-L	5 in.	Camera Mount	5UP1	Aluminum	Round	4$\frac{3}{4}$ Dia.	6 $\frac{1}{8}$ x 6 $\frac{1}{8}$	None	Yes	No
80075-M	5 in.	Camera Mount	5UP1	Aluminum	Round	4$\frac{3}{4}$ Dia.	6 $\frac{1}{4}$ x 6 $\frac{1}{4}$	Standard	Yes	No
80075-N	5 in.	High Impact	5ADP1	Fiberite	Rectangular	4$\frac{1}{4}$ x 3$\frac{3}{8}$	6 $\frac{1}{8}$ x 6 $\frac{1}{8}$	Flat Face	No	Yes
80075-P	5 in.	Flat Face	5ADP1	Aluminum	Rectangular	4$\frac{1}{4}$ x 3$\frac{3}{8}$	6 $\frac{1}{8}$ x 6 $\frac{1}{8}$	Flat Face	No	Yes

MILLEN MAGNETIC SHIELDS FOR CATHODE RAY TUBES

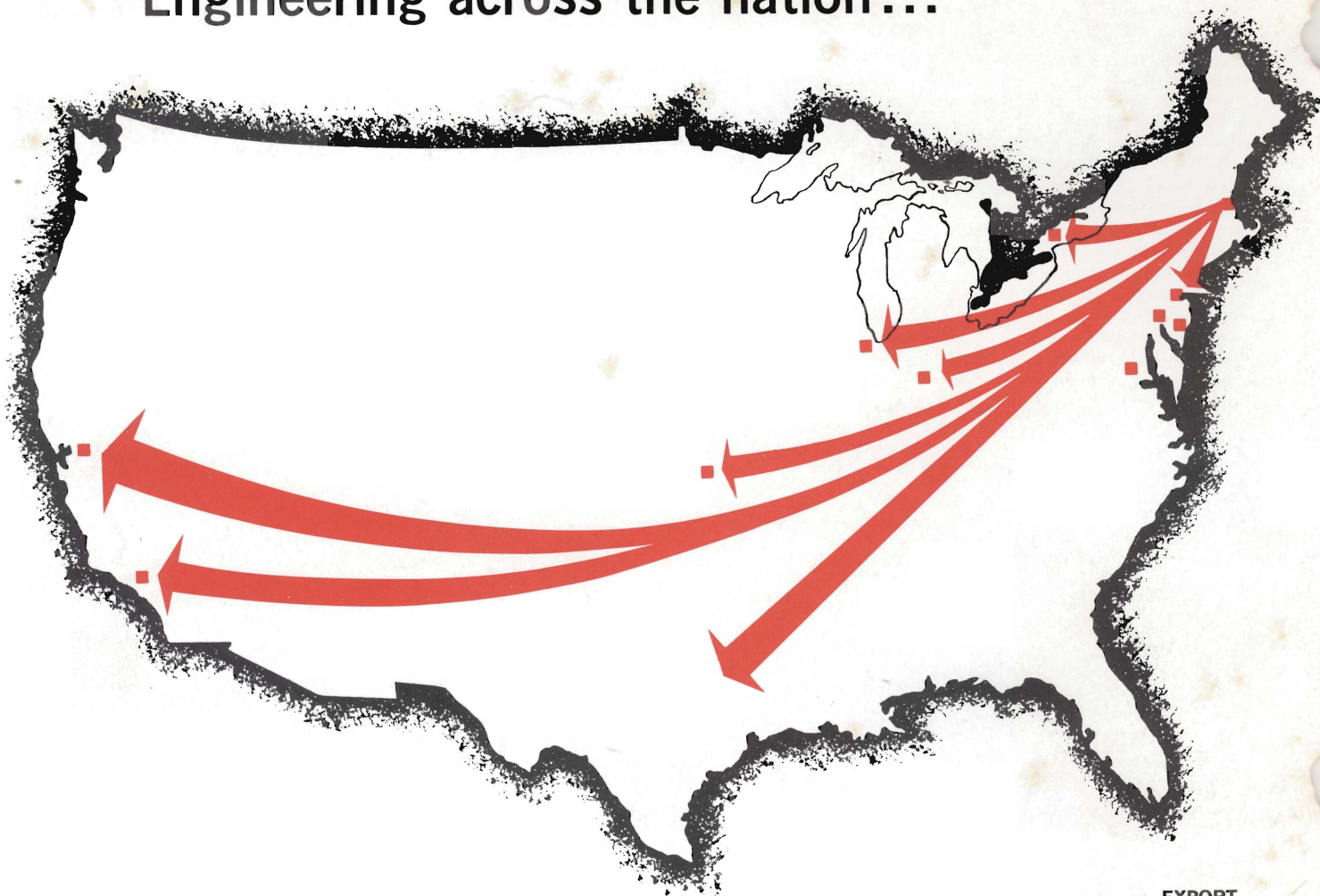
The James Millen Mfg. Co., Inc. has for many years specialized in the production of magnetic metal cathode ray tube shields for the entire electronic industry, supplying magnetic metal shields to manufacturing companies, laboratories and research organizations. The study of such problems has resulted in the use of two outstanding metals for the purpose: NICOLOI and MU-METAL, and has proved the relative ineffectiveness of many substitutes. It is possible by selecting the proper material, that is Mu-metal or Nicoloi, or the correct combination of these materials carefully and properly annealed, to reduce to a negligible point the effect of undesired magnetic fields. Many production programs make desirable shields designed in conjunction with the specialized requirements of the basic apparatus. Our Custom Shield design and fabrication department is at the service of our customers for the development of magnetic metal shields for such specialized application.

The following table lists standard shields and typical tubes which use them. For industrial customers there is available a catalog of drawings giving full details on the standard shields.



Catalog Number	Face Diameter Inside	Neck Diameter Inside	Length	Tube Base Clamp	Material	Typical Tubes	Catalog Number
80022	2½	2½	8	None	Nicoloi	3AP1	80022
80023	2½	2½	6	None	Nicoloi	3AP1	80023
80031	5⅝	2⅝	11⅝	None	Nicoloi	5BP1-5GP1-5HP1-5NP1	80031
80032	5⅝	2⅝	11⅝	None	Mu-metal	5BP1-5GP1-5HP1-5NP1	80032
80042	2⅝	1⅝	5¼	1½ Dia.	Nicoloi	2BP1-2BP11	80042
80043	3.45	2⅝	7½	2¼ Dia.	Nicoloi	3BP1-3DP1	80043
80045	6⅝	1⅝	15½	1.69 Dia.	Nicoloi	5BP1-5GP1-5HP1-5NP1	80045
80045-Z	6⅝	1⅝	14½	1.69 Dia.	Nicoloi	5BP1-5GP1-5HP1-5NP1	80045-Z
80053	3.45	2	9⅝	1.64 Dia.	Nicoloi	3AP1-3KP1-3KP7-	80053
80055	6⅝	2½	15½	2.25 Dia.	Nicoloi	5CP1	80055
80055-Z	6⅝	2½	14½	2.25 Dia.	Nicoloi	5CP1	80055-Z
80067	3¼	2½	7⅝	2 Piece	Mu-metal	3BP1-3DP1-3FP7-3JP7-3ACP1	80067
80085-H	5⅝	2⅝	14½	2¼ Dia.	Mu-metal	5ABP1-5ADP1-5AQP1	80085-H
80801-A	1.325	1.325	2¾	None	Mu-metal	1CP1	80801-A
80801-C	1½	1¾	3¼	None	Mu-metal	1EP1	80801-C
80802-A	2⅝	1⅝	5¼	1½ Dia.	Mu-metal	2BP1-902-A	80802-A
80802-D	2⅝	1⅝	5¼	1⅝ Dia.	Mu-metal	2AP1	80802-D
80803-A	3.45	2	9⅝	1.69 Dia.	Mu-metal	3GP1	80803-A
80803-B	3.45	2	9⅝	1.64 Dia.	Mu-metal	3AP1-3KP1-3KP7	80803-B
80803-C	3.45	2⅝	7½	2.25 Dia.	Mu-metal	3BP1-3DP1	80803-C
80803-D	3.45	1¾	7⅝	1.5 Dia.	Mu-metal	3RP1-3RP1-A	80803-D
80803-E	3.45	2⅝	7½	2.25 Dia.	Mu-metal	3ACP1-3FP7-3JP7	80803-E
80803-F	3.45	1¾	6⅝	1.5 Dia.	Mu-metal	3MP1	80803-F
80803-G	3.45	1¾	9⅝	1.5 Dia.	Mu-metal	3WP1	80803-G
80803-M	3¼ x 1⅝	1½	7½	None	Mu-metal	3SP1-3XP1-3XP7	80803-M
80803-N	2¼ x 1¾	1¾	6⅝	None	Mu-metal	3UP1-3UP7	80803-N
80805-A	6⅝	1⅝	15½	1.69 Dia.	Mu-metal	5BP1-5GP1-5HP1-5NP1	80805-A
80805-AZ	6⅝	1⅝	14½	1.69 Dia.	Mu-metal	5BP1-5GP1-5HP1-5NP1	80805-AZ
80805-B	6⅝	2½	15½	2.25 Dia.	Mu-metal	5CP1	80805-B
80805-BZ	6⅝	2½	14½	2.25 Dia.	Mu-metal	5CP1	80805-BZ
80805-C	5½	2½	15	None	Mu-metal	5RP1	80805-C
80805-D	5½	4½	16	None	Mu-metal	5SP1	80805-D
80805-E	6⅝	1⅝	14⅝	1.625 Dia.	Mu-metal	5LP1	80805-E
80805-F	6⅝	1⅝	13⅝	1.5 Dia.	Mu-metal	5UP1	80805-F
80805-FZ	6⅝	1⅝	13⅝	1.5 Dia.	Mu-metal	5UP1	80805-FZ
80805-G	6⅝	1⅝	14¼	1½ Dia.	Mu-metal	5JP1-5JP2-5JP11	80805-G
80805-GZ	6⅝	1⅝	14½	1.69 Dia.	Mu-metal	5JP1-5JP2-5JP11	80805-GZ
80805-H	6⅝	2½	15	2.25 Dia.	Mu-metal	5ABP1-5ADP1-5AQP1	80805-H
80805-HZ	6⅝	2½	14¾	2.25 Dia.	Mu-metal	5ABP1-5ADP1-5AQP1	80805-HZ
80805-J	6⅝	2½	16⅝	2.25 Dia.	Mu-metal	5YP1	80805-J
80805-JZ	6⅝	2½	15½	2.25 Dia.	Mu-metal	5YP1	80805-JZ
80805-K	6⅝	2½	15¾	2.25 Dia.	Mu-metal	5ATP1-5AMP1	80805-K
80805-KZ	6⅝	2½	15¾	2.25 Dia.	Mu-metal	5ATP1-5AMP1	80805-KZ
80805-L	6⅝	2½	14¾	2.25 Dia.	Mu-metal	5ABP1-5ADP1-5AQP1	80805-L
80807-A	7½	3	12½	None	Mu-metal	7GP4-7JP4-7UP1	80807-A
80815-A	14¾	6¼	9¾	None	Mu-metal	15" Color Tube	80815-A

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